REMARKS FOR ADMINISTRATOR BOLDEN
BOEING LECTURE SERIES – PURDUE UNIVERSITY
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Thank you to the College of Engineering and the Indiana Space Grant Consortium for inviting me to speak with you tonight. It's a pleasure to be at one of our nation's great universities. I would like to express my appreciation to France Córdova, Purdue President and a former NASA Chief Scientist, for her shining example of all that can be accomplished in science, technology, engineering, and mathematics, or STEM. Dr. Córdova was the first woman and youngest person ever to hold the position of NASA Chief Scientist. Another NASA "alumnus" here at Purdue is former NASA Goddard Space Flight Center Director Al Diaz, now Purdue's Executive Vice President for Business and Finance.

Many of our astronauts count Purdue as their alma mater. From our first moonwalker Neil Armstrong to Mark Polansky, commander of last year's STS-127 space shuttle mission, I count 22 astronauts among the ranks of Boilermakers. This place, these halls, have contributed an awful lot to the space program and through that the economic well being of this nation, our national security and, yes, the spirit of our country through the vast inspiration that exploration provides.

I love that you have a College of Engineering, a College of Science, AND a College of Technology. This is my kind of place.

Earlier today, I spoke to the interns from Purdue who spent their summer at NASA. Speaking to such students is one of the most rewarding things I do as administrator. Students who are just starting their college careers are excited about the future. They are fired up about what lies ahead for the space program and the chance to create capabilities that we don't have today. They want to be a part of something larger and they want to contribute to national goals.

We're often asked to justify the space program -- which, by the way is only about .6% of the entire federal budget -- in light of so many other pressing world problems here on the ground, from poverty to disease and war. But the fact is that space exploration has made huge contributions to all of the problems we face as a planet.

Technology like we use in our water processing systems on the International Space Station (ISS), for instance, is helping people in remote

areas get access to water. ISS research has helped us learn more about Salmonella and has led to a candidate vaccine, and we're also studying other pathogens. Many of the tools and technologies we take for granted came about as a result of exploration. It's an impressive list that you can peruse on our NASA website.

But I want to emphasize how exploration improves life for people everywhere on Earth and helps us solve a lot of problems that are universal. You need only look at the partnership between 15 nations – including our former Cold War rival, Russia - that created the International Space Station to see how exploration brings our world together.

I'm one of the still-too-small group of people who have witnessed our home planet from above, without visible borders. I had the privilege of working with international crews, all focused on the same big goals and sharing our triumphs and successes as a team. I hope many more people have the chance to experience that in the years to come. I want that world for my grandchildren.

Let me get back down to Earth. I also spoke today to 4th – 5th graders participating in the FIRST Robotics competition. They're working on real world challenges and asking some of the same questions our scientists and engineers do when they build a robot to send to space or another planet. I think we really have to grab kids at this age. They have to be engaged at the earliest grades and make science, technology, engineering and math studies a regular part of their curriculum so they don't seem alien, so they don't seem like huge scary subjects…FIRST makes it tangible. It demonstrates a connection between the subjects they've been studying and real world applications.

At the high school level in the FIRST program, when students are building real robots out of metal and gears and controllers, they basically have to do a complete mission turnaround in a very brief period -- including completing a full engineering requirements analysis, brainstorming, developing a concept, then designing it, building it, developing the software and integrating everything, documenting their work, testing and debugging. And then their robot actually competes against others. The goal isn't simply to build a robot, but to provide a vehicle for learning much more, with an

ultimate goal of building a collaborative team, a supportive community and a solid strategy for problem solving during the competition.

NASA sponsored nearly 300 of the 1800 teams that participated in the 2010 FIRST international competition. Boeing and several other major corporations are also big supporters. We plan to continue our involvement with this great program.

I was asked to speak tonight about NASA's vision for the future of exploration. Our Nation’s leadership is still working out the details of the budget for NASA for next year, but a few things are clear.

The nation has established exploration as a priority. It wasn’t that long ago that we had to justify why we were pursing human space flight at all as a Nation. That is no longer in question—we will be doing human exploration, and we plan to develop the capabilities needed to go beyond low Earth orbit, farther into our solar system. The discussion underway now will determine the path we take to achieve this future of new capabilities and a new way of looking at space. We are no longer discussing whether or not we should be pursuing exploration at all. That's a positive shift in the

dialogue and a real testament to the accomplishments of NASA and the entire aerospace industry over the past decades.

The President released his National Space Policy in June. It's part of a national focus involving many agencies. A major goal is to enlarge and reinvigorate American research and development. The policy brings focus to efforts needed today to enable a bright future with space as an even larger part of the Nation's efforts. This Policy will insure the U.S. remains at the forefront of innovation. We're going to develop the capabilities that help our nation both in space and here on Earth. In doing so we'll inspire those young and not so young, and actively encourage students to dream and build and become the engineers and scientists of tomorrow.

We've achieved amazing things already. We've landed robots on Mars, for instance, and they've roamed the Martian surface and sent amazing, high-resolution images of the Red Planet back to Earth; we've created and successfully launched the world's largest fleet of Earth observing satellites that have provided insightful data about our planet's climate, water levels, ice coverage, and so much more. We've launched 356 men and women into space on the Shuttle. But President Obama now wants us to focus on

new and emerging capabilities we'll need to make huge leaps in the decades ahead – to take the necessary steps to develop and flight test new exploration systems. Several examples are propulsion systems that allow us to reach Mars much quicker than the current 8 month trip; closed loop life support to make it feasible to live on another planetary body or just get there in the first place; precision landers that can scout future destinations at the same time as they test technologies and make scientific discoveries. Strong research universities like Purdue will no doubt play a critical role in all of this critical work.

There are many things in the plan for FY11 that seem to be certain, like extending the International Space Station to at least 2020, increasing support for many science missions, especially in Earth science, ramping up funding for the next generation of science and aeronautics research, and expanding our education activities to help us widen the pipeline for future leaders.

One of the key things is that next generation of technology. These are technology capabilities experts in the field have agreed for years we need for long duration, deep space missions. A new heavy lift rocket that can get

us out into deep space seems likely to be one of our priorities, as well as some mix of the systems I mentioned earlier. We have a new Chief Technologist, Dr. Bobby Braun, one of our youngest NASA leaders at age 44, and he's helping guide our planning for technology development when the FY11 budget is approved.

There’s an open letter to students from Bobby on the AIAA website. He makes a lot of good points and challenges today’s students to become tomorrow’s innovators. One of our immediate needs is to inspire the next generation and give them the hands on opportunities to develop hardware and flight test it.

When you think about it, it’s not a long timeline for the students we’re attempting to inspire to be the scientist and engineers conducting these missions. Today’s college sophomores will be about 35 by the time we reach an asteroid in 2025 as the President has proposed. Still pretty early in their careers. They’ll be in their mid-40s by the time a manned mission to Mars takes place. I want them to have the chance to excel and create the world of tomorrow with its stunning possibilities as was done by the

Mercury, Gemini and Apollo generation and the scientists and engineers who constructed and launched the Hubble Space Telescope.

NASA's new direction has been widely reported as a cut, but it's not. It's a $6 billion increase over the next 5 years. That's a huge vote of confidence by the President and Congress in these tough times.

We are working to enable commercial access to low Earth orbit, that area that extends to where Hubble and the space station are, 250 – 400 miles above us. With congressional approval, we're going to keep working with companies both large and small to open up this entirely new segment of the economy – companies that can launch to space and the many businesses that provide things like communications and supporting equipment -- that we think will spur jobs and innovation for decades to come. Those are jobs that the students of today will be able to pursue.

The International Space Station that has been our focus for much of the past two decades is an engineering marvel. I truly could never have imagined when I was a child that in my lifetime we would have an orbiting facility the size of a football field, with an international crew on it 24/7. And

we're going to have it for at least another decade, so there will be many opportunities for students and educators, researchers and industry to put experiments on it (and outside of it!) and gather information in a way that's possible nowhere else.

We are really thinking hard about where we want to be in a generation, not just the next five years. To move beyond that vehicle-driven approach to think in broader terms about the capabilities we need in order to do a wider range of things and serve a wider range of people -- from other government users of space to our international partners, industry, academia and the private citizen.

You asked about “vision,” so please allow me to tell you what I envision for the future of space exploration in years to come as we pursue NASA’s exciting goals. I will address human exploration, but also exploration by our amazing science missions that go out into the universe and also help us better understand our own planet. We also have an incredibly robust aeronautics program that will greatly improve the future of air travel.

Over the coming decades, NASA is determined to work with people everywhere to achieve continued and expanded exploration of space with humans that will drive prosperity on Earth through innovations and technologies not even imagined today. Through our exploration endeavors we will expand our economic sphere, expand our minds through exciting scientific discoveries, and expand our imaginations by going to new places in the solar system.

In the upcoming decades we truly hope to witness the first boots on Mars, fulfilling the dreams of generations who have come before. As our first astronauts shake the red soil from their boots, they will prove once and for all that humans are meant to explore.

We may be able detect the earliest forms of matter, galaxies, and stars in the universe with the James Webb Space Telescope. We will be able to probe the event horizon of a super-massive black hole in another galaxy with the International X-ray Observatory. Through our astrophysics missions, we may be able to peer back to the very beginnings of the universe.

In Earth science NASA, with our international partners, has deployed and are maturing a Global Earth Observation System of Systems. In the future this system will enable routine extended weather forecasting and multi-year climate predictions on a regional basis.

Future airplanes will be more efficient, less polluting, and quieter. They will use much lighter, high temperature materials and structures and potentially hybrid-electric propulsion systems.

We're constantly working on ways for young people to get involved with NASA and hopefully pursue careers in our wonderful world. We recently announced a competition for high school students to participate in a program called "SPHERES" in which they design software to program small, soccer ball sized satellites aboard the International Space Station. These little satellites are used to test maneuvers for spacecraft performing autonomous rendezvous and docking. Three of them fly inside the station's cabin, and they're each self-contained with power, propulsion, computing and navigation equipment. How exciting to have worked on one of these when I was in school.

Our Minority Innovations Challenges Institute is working to create a virtual training ground where minority undergraduate students learn how to compete in NASA technical challenges, sometimes for significant cash prizes. These activities will focus on competitions found within NASA's Centennial Challenges program, which provides cash prizes from $50,000 to $2 million to individuals or teams that can achieve specific technical accomplishments.

We're kicking off a "One Stop Shopping Initiative," where undergraduate and graduate students who want to apply for a NASA internship or fellowship soon will have access to all of NASA's opportunities on a single website. At an education summit next week, we're going to iron out some of the kinks and bring together people interested in participating and creating even more opportunities. And we also want to develop ways to maintain the connection with these passionate young people who come to us for work and learning experiences. We want to stay in touch, see where their careers take them and help them open doors at NASA, if that's where they want to go.

Among our current exciting science missions, EPOXI, the repurposed Deep Impact spacecraft – you remember the one that carried the impactor that hit a comet a couple of years ago? – well, it reaches the Comet Hartley 2 in November for extended examination of this mysterious object. Also in November…we'll launch a space shuttle with a robotic crewmember, Robonaut 2 (R2). R2 was developed through a Space Act Agreement between General Motors and NASA to work in the auto industry and will now be tested for applications in space.

In March next year, MESSENGER will become the first spacecraft ever to orbit Mercury.

The Mars Science Laboratory, dubbed Curiosity, launches in November 2011. It'll be the largest rover we've ever sent to the Red Planet, about the size of a small car, and it will carry its own laboratory, as the name suggests. One of its prime goals will be to help us learn more about whether or not Mars has ever been hospitable to life.

In 2014 we plan to launch the James Webb Space Telescope to a point a million miles away. It's hard to imagine that distance, but Webb is going to

be the most advanced observatory we have, and it will peer back to the very beginnings of the universe.

The New Horizons spacecraft reaches Pluto in 2015, and that mysterious dwarf planet will get its first thorough examination.

In Earth Science, new missions to study ice sheets and carbon cycles and climate change and many other processes of our planet are in development.

As I mentioned earlier, we have many plans in aeronautics. Tomorrow I speak at a green aviation summit in California. We're actively working with the FAA and others to develop the air transportation system of tomorrow - the Next Generation Air Transportation System (NEXTGen). If you go to our website, you'll see some of the prototype vehicles that we've solicited as a base for starting to develop some new aircraft on which we may all be traveling in the future.

To do all this, as I've already said, we need the brightest American minds pursuing science, technology, engineering and math. How we recruit those

students, how we get them interested, and keep them interested, at a young age, is a huge challenge.

We're going to need smart people in all disciplines -- biologists, medical professionals, psychologists, geologists, and materials scientists. You name it in engineering and science, and we are going to have a need for it as we move out on the space missions for which we are laying the groundwork today. That 30-year grid is filling up fast.

I know Purdue and our nation's other universities will continue to turn out graduates with skills and knowledge they can apply for the betterment of our nation and our world. At NASA, we will do our part to keep our vision big, but achievable. I want you all to stay with us and stay on that cusp of imagination, wonder, and an insatiable quest for knowledge. Believe me, the best is yet to come!